IP Protection in Java Based Software

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Java - The preferred choice

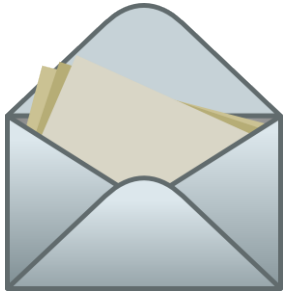
- **A simple Object Oriented Language**
- **VM approach, Platform independent**
- **Omnipresent - Presence on Desktop, Web browsers and Devices**

Java Vulnerabilities

- Java is highly vulnerable to reverse engineering
- JVM is open source – easily available source code
- Java .class file format is publicly available
- JVM has fewer instructions than native code
- 3rd party dissemblers increase vulnerability
- JVM is a software and not a hardware – the environment can be controlled

How to protect Java based software ?

1. Byte code encryption
2. Hardware assisted byte code encryption
3. Wrapping/Enveloping
4. Obfuscation



Byte code encryption

- Encrypt the byte code so that it is not visible
- Byte code is not touched

- JVM does not understand encrypted classes, hence classes need to be decrypted prior to loading
- JVM is open source - Classloader.defineClass() can be patched to dump the byte code

Byte code encryption (contd…)

- **Instrumentation APIs can circumvent all encryption**
- **Needs a custom class loader to decrypt class definitions**

Hardware assisted byte-code encryption

- Strips and encrypts annotated fields and methods
- Moves the fields and method to the hardware
- Modifies byte-code to route the method calls and field references to the hardware
- Hardware contains embedded slave-processor which executes the encrypted code

- Heavy performance degradation

Enveloping

- Wraps and embeds the jars into the native executable

pros

- Provides robust protection
- No source level changes are done
- Provides Data protection, IP protection, Copy protection
- Produces a single executable file

- Jars embedded as resources are easy to extract
- JVM launched as a separate process can be manip

cons

Obfuscation

Obfuscation

- Obfuscation is the hiding of intended meaning, making things confusing, willfully ambiguous, and harder to interpret
- When applied to byte code, makes it very hard to make sense of the decompiled code
- Techniques employed in obfuscation
  - Name Obfuscation. - replacing identifiers with meaningless character sequence
  - String Encryption - Replacing string literals with calls to a decryption method that decrypts its parameter
  - Control and Data Flow obfuscation – Modifying flow to yield the same result but making it impossible to decompile into a well-structured Java source

Obfuscation

- Suppression of End Of Line Characters - Makes code difficult to parse
- Use of anonymous classes for handling events.
- Class file encryption.

- Issues with obfuscated byte code
  - Stack traces show obfuscated identifiers
  - Difficult to debug and support

- Most obfuscators provide a mechanism to rebuild the original stack traces from the obfuscated ones



Obfuscators – A comparison

Sr. No	Featuresä --- Productsâ	Pro-Guard	Klassmaster	DashO-pro	Allatori	Smokescreen
1	Shrink Support (Removes unused code - classes, fields and methods)	✓	✓	✓	✓	✓
2	Optimization	✓	✓	✓	✓	✗
3	Obfuscation	✓	✓	✓	✓	✓
4	Pre-verification (aides in faster loading of classes)	✓	✗	✗	✗	✗
5	Reflection Support	✓	✓	✓	✓	✗
6	Resource file support	✓	✓	✗	✓	✗
7	String constants encryption	✗	✓	✓	✓	✓
8	Flow Obfuscation Support	✗	✓	✓	✓	✓
9	Incremental Obfuscation	✓	✓	✓	✓	✓
10	Reconstruction of obfuscated stack traces	✓	✓	✓	✓	

Sr. No	Featuresä --- Productsâ	Pro-Guard	Klassmaster	DashO-pro	Allatori	Smokescreen
11	Ant Support	✓	✓	✓	✓	✓
12	GUI Suppport	✓	✓	✓	✗	✓
13	Supports all JDK Versions	All versions	1.5 - 7	?	?	?
14	Watermarking	✗	✗	✗	✓	✓
15	Byte code Encryption	✗	✗	✗	✗	✗
16	Ahead-Of-Time Compilation	✗	✗	✗	✗	✗
17	Tamper Detection & Notification	✗	✗	✓	✗	✗
18	Obscurity and resilience score	--	High	Low	High	Very High
19	Performance degradation	--	Medium	Low	Medium	High
20	Vendor	Open Source	Zelix Pty Ltd	PreEmptive Solutions	Smardec	Lee Software
21	License Type	GPL	Commercial	Commercial	Commercial	Commercial
22	License Cost	0	Single machine - $480 Site License - $1800	?	Single machine - $290 Site License - $3750	Single User - $650

Obfuscation Demo



Questions?

Thank You.